involved in establishing shore connection. The activity of the *Jacques-Cartier* in this respect has been constantly increasing. During the return voyage of March–April 1924 (Vancouver to Bordeaux) she received 61 observations from French ships and 338 from foreign ships of all nationalities. Certain of these vessels kindly acted as relay stations for the picking up of observations of ships still more distant. On the Atlantic the observations received averaged some 30 per day.

This network of oceanic observations, of an extent and closeness hitherto unknown, reaches Paris simultaneously with the regular observation of the *Jacques-Cartier*, and France insures their being broadcast throughout Europe by incorporating them in the meteorological message sent from the Eiffel Tower.

Very recently (November, 1924) a still greater advance has been achieved by the use of very short wave lengths (115 meters). The meteorological messages from the *Jacques-Cartier* have been received at Paris directly, during a complete Atlantic crossing (Bordeaux to Panama), and even, at certain hours, when the ship was in the Pacific.

2. *The work of a floating station for the forecasting of ocean weather.*—In addition to the ship observations which it collects, the *Jacques-Cartier* has at its command the European and American meteorological radiograms received on board.[1] Charts, sometimes more correct over the ocean than over the land, can therefore be regularly drawn twice a day on board, a fact which allows the working up of weather forecasts *on the spot* (an enormous technical advantage) and the broadcasting of them by radio for the great trans-Atlantic routes. Westbound ships experience frequent and rapid changes of weather, and such forecasts have for them a special interest. In the case of the fast eastbound liners, they are not passed by more than one depression at most, even in winter. Hence it is sometimes possible to indicate for them, as early as the time of their leaving port, the broad characteristics of the weather changes for their whole voyage. The forecast service of the *Jacques-Cartier* has become steadily more popular at sea. Thus in bad weather it is not uncommon for vessels in the neighborhood to cease sending in order to listen to her message; and frequently special forecasts are asked for.

It is the value of these forecasts, based on the modern methods developed in France and Norway, which assures the growth of the *Jacques-Cartier's* "station" network, through its "clients" for the receipt of weather forecasts becoming its "purveyors" of observations.[2]

The forecast studies on board of the *Jacques-Cartier* have advanced our knowledge of dynamic meteorology. From these studies, the results of which will be presented in due time by their authors, Mm. Coyecque and Wehrlé, we may for the present draw two general fundamental conclusions: (1) The conception that the Atlantic Ocean acts as a barrier (écran) [to the passage of disturbances from North America to Europe], is no longer tenable; the progress of perturbations is continuous across the Atlantic. (2) The action of the polar front makes itself felt at times down to the region of the Equator; the trade winds are only approximately "permanent."

[1] The sending from the Eiffel Tower of messages on very short wave lengths permitted in November, 1924, the communication direct to the *Jacques-Cartier* of the meteorological situation over Europe during the entire Atlantic crossing.

[2] Mention should be made also of the hearty cooperation of the U. S. Weather Bureau in giving very efficient publicity to the work of the *Jacques-Cartier* through the medium of the Pilot Charts. [For two notes descriptive of the meteorological activities of the ship, see North Atlantic Pilot Chart for March, 1923, "Storm and Weather Forecasting on the Atlantic Ocean"; and for December, 1924, "Meteorological Service of the *Jacques-Cartier*." The bulletin of the National Research Council for January, 1924, pp. 100, 101, contains a note by E. H. Bowie on "The meteorological work of the *Jacques-Cartier*."—B. M. V.]

The success of the tests made by the *Jacques-Cartier* has demonstrated the possibility and the utility of a service which shall collect observations and make forecasts for the Atlantic area. Since 1923 the International Meteorological Committee has given its support and its official recognition to the project. The proper thing now is to organize this service definitely through international cooperation.

HATTERAS DEPRESSIONS

By M. COYECQUE and PH. WEHRLÉ, National Meteorological Office of France

[Translated from *Comptes Rendus*, 179, No. 26, December 29, 1924, pp. 1617–1620, by B. M. Varney, Weather Bureau, Washington]

1. *The facts, based on observations on board the "Jacques-Cartier."*—The region off Cape Hatteras distinctly constitutes a birthplace of atmospheric disturbances. A faint nucleus of barometric depression appears, at first almost stationary. It grows, accompanied by the development of a heavy A. St. Finally the Hatteras depression, with isobaric system fully formed, begins to move slowly toward the northeast, but does not reach normal velocity until it is opposite Nantucket Island. Opposite Newfoundland it turns definitely toward the east, thus getting into line with the series of polar LOWS (depressions along the polar front, properly so called), either merging with one of the latter or maintaining its own individuality. Hatteras depressions affect almost the whole of Europe, and at times extend into rather low latitudes. They are usually intense enough to cause gales from northeast around to northwest in American waters from Hatteras to Newfoundland. The storm connected with the Hatteras LOW may traverse the Atlantic (e.g., January 8, 1924).

The frequency of the Hatteras depressions is of the order of 20 per year. Their formation is almost entirely confined to the cold season. It always induces the movement, out of the north or northwest, of an intense high-pressure center with a complete anticyclonic circulation. The depression appears along the border zone, between the warm air current from the southwest directed by the Atlantic anticyclone and the cold current from the easterly sector controlled by the moving anticyclone.

The process may, however, develop somewhat differently, the depression being extremely weak (sometimes even lacking a cloud system), and moving slowly from the west to the region opposite Hatteras, where it begins rapidly to become more intense. A secondary Hatteras depression and even sometimes a tertiary of decreasing intensity, is sometimes related to the same high pressure center.

2. *Interpretation.*—The strong high-pressure center essentially represents an invasion of polar air,[1] and the formation of the Hatteras LOW is due to the contrast between the temperature of this air and that of the very warm tropical air above the Gulf Stream; hence the geographic localization. But in summer the polar air is warmed over the continent; hence the seasonal localization.

Two types of Hatteras depression should be recognized: (*a*) The LOW formed at the expense of the mother cyclone, which, as in the case of the April 19, 1922, cyclone, disappears. This type of Hatteras depression is characterized by the presence in its northern sector of a very clear line of discontinuity (thus forming an extra front resembling

[1] See J. Bjerknès and K. Solberg, The Evolution of Cyclones. Memoir of the National Meteorological Office of France, No. 6, 1924, pp. 95 ff.

that along the [true] cold front), but separating two masses of polar air [which formerly constituted the two currents on opposite sides of the cold front] of the parent cyclone, namely, the returning polar air from the east which is relatively mild, and the new polar air from the northwest, which is very cold.[2]

(*b*) The parent cyclone persists (case of January 17, 1922). The northern sector of the Hatteras LOW is then made up of a homogeneous mass of cold air. This condition of affairs, which is the most frequent condition, especially in winter, demands a powerful invasion of polar air, thus putting an end to the series of cyclones in the family.[3] Under these conditions several Hatteras LOWS are produced in succession. If the invasion is powerful enough it may even continue its progress toward the south and form (in autumn and spring) an "*Antillaise.*" [4]

The fact that the Hatteras depressions are young explains their lasting all the way across the Atlantic Ocean. Born at the end of a cyclone family, their trajectories in the nature of the case lie farther to the south, and they are able to come on shore in Europe at a lower latitude (unless the Azores anticyclone, by shifting toward the northeast, forces them nearer Iceland). Always if they unite with a polar LOW it is necessarily with the first member of the next succeeding family, and hence at a fairly high latitude.

In case where the original depression comes from the west, it seems to proceed from a California pseudofront resembling a Mediterranean pseudofront (the Pacific anticyclone being substituted for the Atlantic anticyclone), [5] or from a southern branch of the Pacific polar front, which divides by fission when it runs foul of a weak continental anticyclone.

3. *Contribution to general dynamic meteorology.*—The first type of Hatteras LOW is to be likened to the Genoese depressions. But in the case of the latter the cutting off of the warm sector (seclusion)[6] is accomplished only by the chain of the Alps; while in the case of the Hatteras depression it is the severed tropical "root" of the mother cyclone which is revitalized by the effect of the contrast in temperature, *whence we have a confirmation of the idea that the phenomena of regeneration of cyclones tend to favor certain regions.*

The second type is to be compared with the Mediterranean pseudofront. But in America, it is in winter that the low temperature of a mass of polar air crossing the continent is best retained, while for Morocco it is in summer, since the journey is an oceanic one. Furthermore, in America, in the absence of a center of action, the temporary invasion by a moving anticyclone can give birth to only an occasional disturbance. In contrast to this, in the eastern Atlantic a polar invasion reinforces a great anticyclonic *massif* along [the border of] which a persisting control can function. In any case *the building up of the polar front by the mechanism of wave formations operates preferably in regions where special seasonal controls favor a seasonal development of the phenomena.*

In view of the analogy between the great warm and cold currents in the western Pacific and the western Atlantic, it is not impossible that some of the polar LOWS of America have their origin over Japanese waters through a mechanism similar to that which causes the Hatteras depressions.

The Hatteras depressions may unite either with the polar LOW which comes immediately after their parent cyclone, or with the following LOW. They show (1) *the interference of well developed and intense depressions;* (2) *that a wave formation may unite with a depression belonging to the next succeeding cyclone family.*

[1] This situation will be made clear by reference to J. Bjerknès and H. Solberg, Life Cycle of Cyclones and the Polar-Front Theory of Atmospheric Circulation. Geofysiske Publikationer, 3, No. 1, Kristiania, 1922. See especially p. 10, the right-hand diagram of Figure 6.
See also the review and discussion of the above paper, by A. J. Henry in MO. WEATHER REV., September, 1922, 50: 468–474. The Figure 6 cited above is reproduced on p. 470.

[2] J Bjerknès and H. Solberg, *loc, cit*, p. 91 ff.

[3] [This name, which has not, as yet, acquired standing in meteorological terminology, seems to be here applied to a northerly wind caused somewhat as the Texas "norther" is. Professor Talman suggests that it may be the "nortes" of the old Spanish navigators in the Antilles.—B. M. V.]

[4] See Ph. Schereschewsky and Ph. Wehrlé, Pseudo Polar Fronts. Comptes Rendus, 179, 1924, p. 1185.

[5] *Loc. cit.*, p. 1618.

METEOROLOGICAL SUMMARY FOR JANUARY, 1925, IN SOUTH AMERICA

[Reported by Señor Julio Bustos Navarrete, director El Salto Observatory, Santiago, Chile]

The month was relatively rainy in southern Chile, northern Argentina, and Bolivia. Cyclonic depressions were frequent in the southern part of the Continent; at Punta Arenas the pressure fell to 28.94 inches (735 mm.) on the 7th.

On the 21st an important anticyclonic center was situated off the Atlantic coast from Bahia Blanca and the mouth of the Rio Negro; the maximum pressure at this time was 30.32 inches (770 mm.).

In general, temperatures were rather high in central Chile and on the Atlantic coast. Maximum temperatures of 104° and 95° (40° C. and 35° C.) were recorded at Buenos Aires and Santiago, respectively. The lowest temperature observed was 29° (−1.6° C.) at Lonquimay in the Chilean Andes.

Electrical storms with rain and hail were rather frequent at La Paz and Sucre.

Director Navarrete submits two weather maps, one each for January 7 and 21. The first portrays a deep barometric depression centered over the extreme southern tip of the Continent with an area of high pressure over the Pacific just west of Chile. This is the type of cloudy, rainy weather in Chile.

The second map presents a different pressure distribution, viz, a strong anticyclone centered over the Atlantic coast east of Argentina. This is a type of fair weather with partial cloudiness in the central regions of Paraguay and Argentina.